

Fermilab

Work on Instrumentation for LHC

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Fermilab

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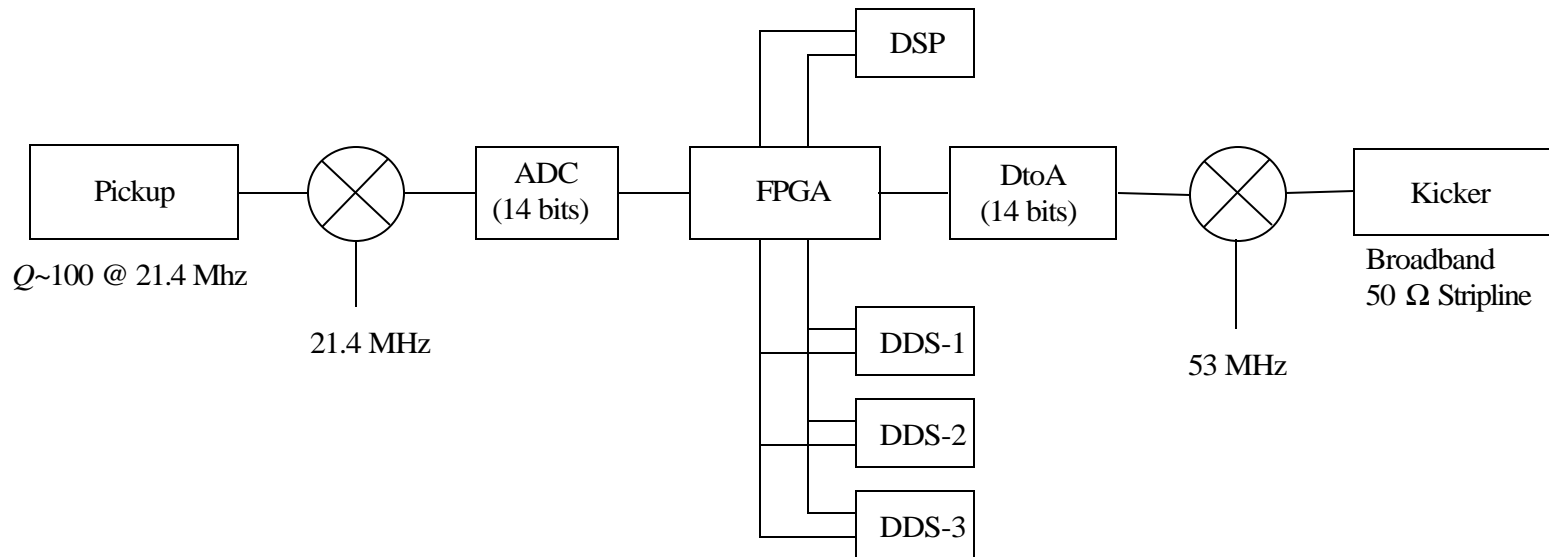
Tevatron Tune Tracker

- A tune tracker design concept has been developed.
- The tune tracker utilizes a standard phase locked loop.
- Some special features
 - System is based on digital technology.
 - System is highly programmable.
 - System uses 3 tunable oscillators.
 - ❖ A pulsed oscillator for coarse resolution.
 - ❖ One higher and one lower frequency for fine resolution.



Tevatron Tune Tracker

Block Diagram





Tevatron Tune Tracker *Status*

- The hardware design has been completed.
- The software has been completed and tested in simulations.
- The system will be fabricated by the end of the shut down and will be tested when operations resume.



Future Work

- Test system with beam and understand problems of operation in the Tevatron environment.
- Understand advantages/disadvantages of operating with a pulsed excitation.
- Understand how to use multiple oscillators effectively.



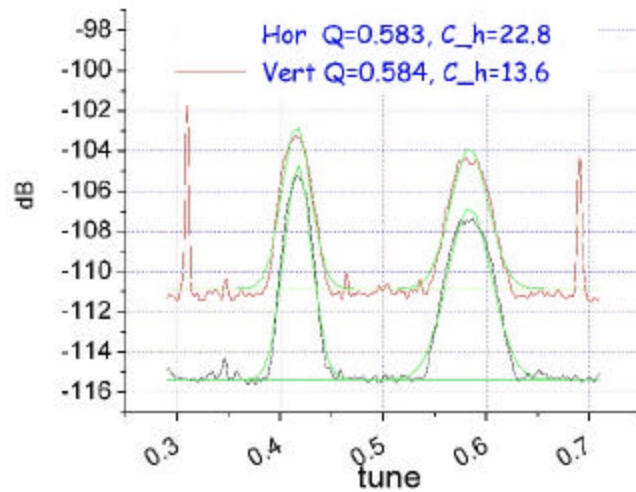
Wideband Schottky Pickup

- Center frequency is about 1.8 GHz and the Q is about 10.
- Adequate sensitivity and bandwidth to measure single bunches of protons and antiprotons.
- Ability to measure
 - Tunes
 - Chromaticity
 - Emittances
- Some problems with coherent signals and tune coupling, especially while the machine is ramping.

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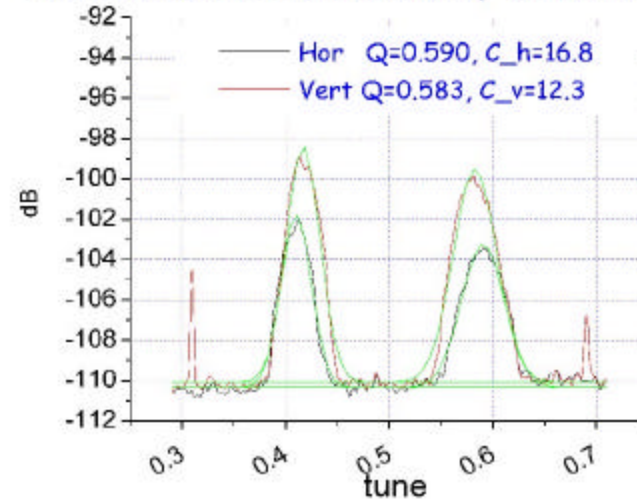
Tune and Chromaticity

2.5 hrs #2692: 1.7Ghz Schottky for All Protons



Antiprotons

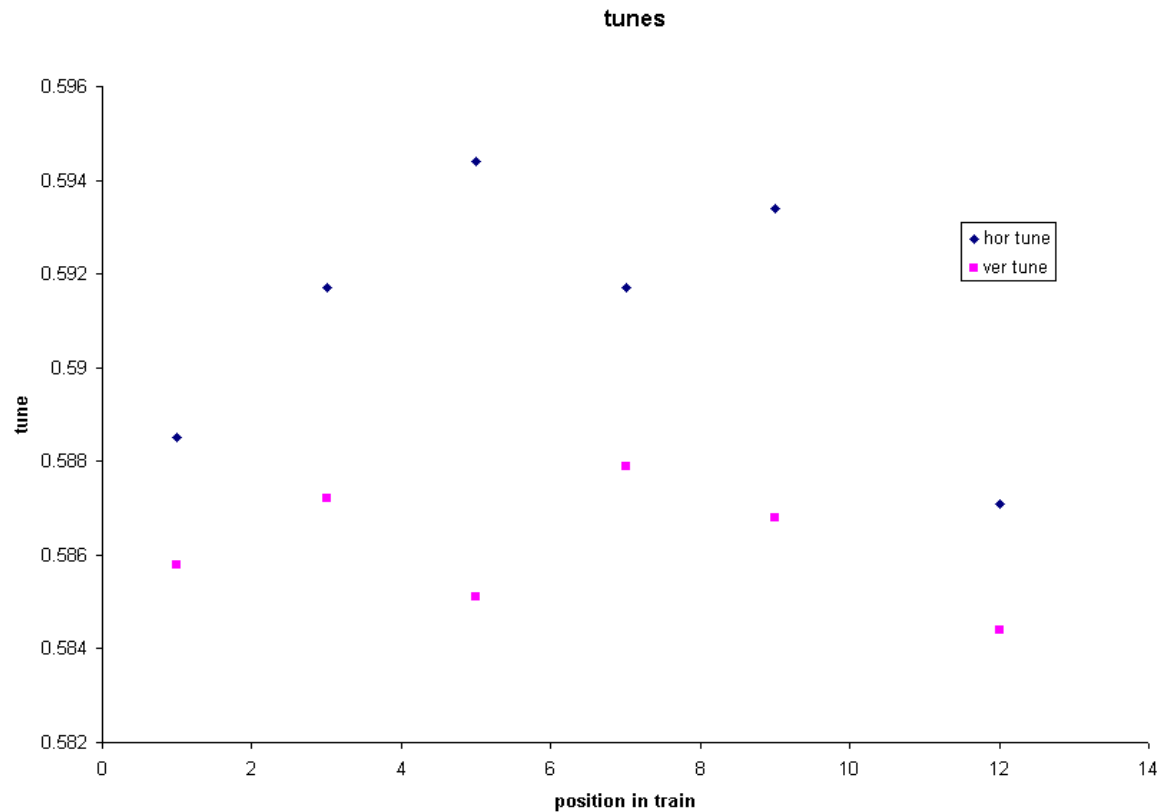
2.5 hrs #2692: 1.7Ghz Schottky for All Protons



Protons

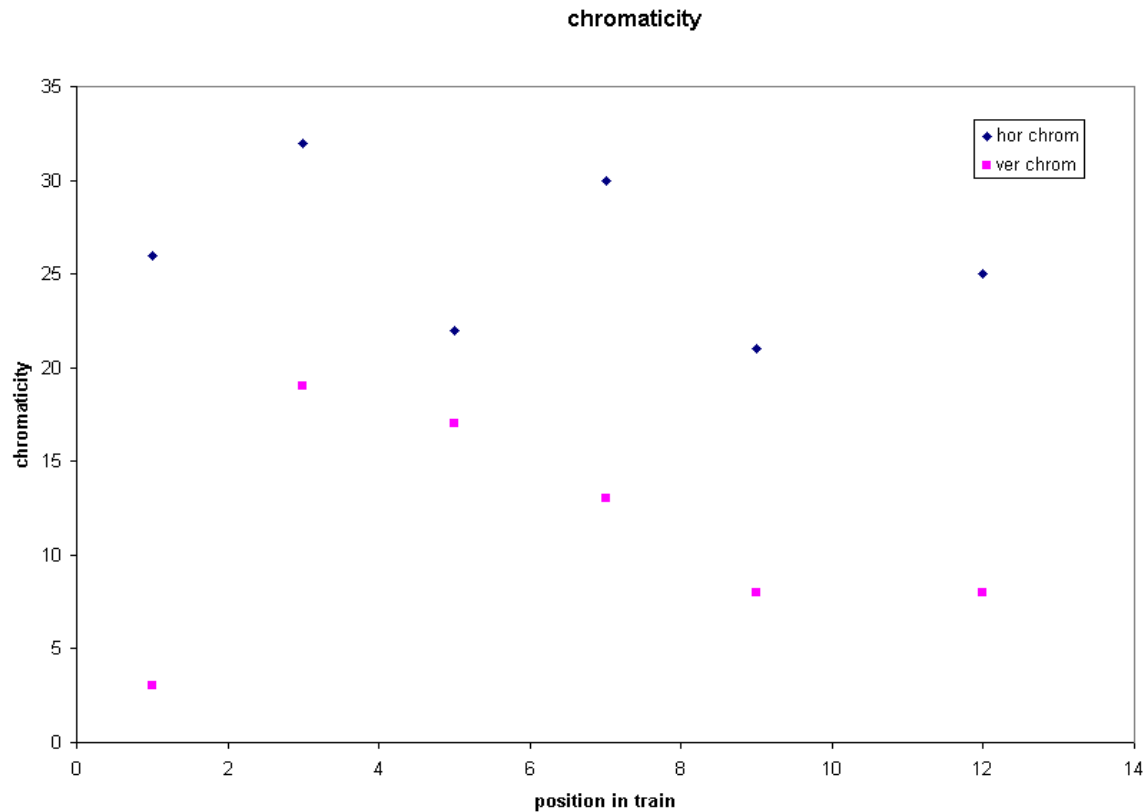
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Bunch-by-Bunch Tunes



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Bunch-by-Bunch Chromaticity

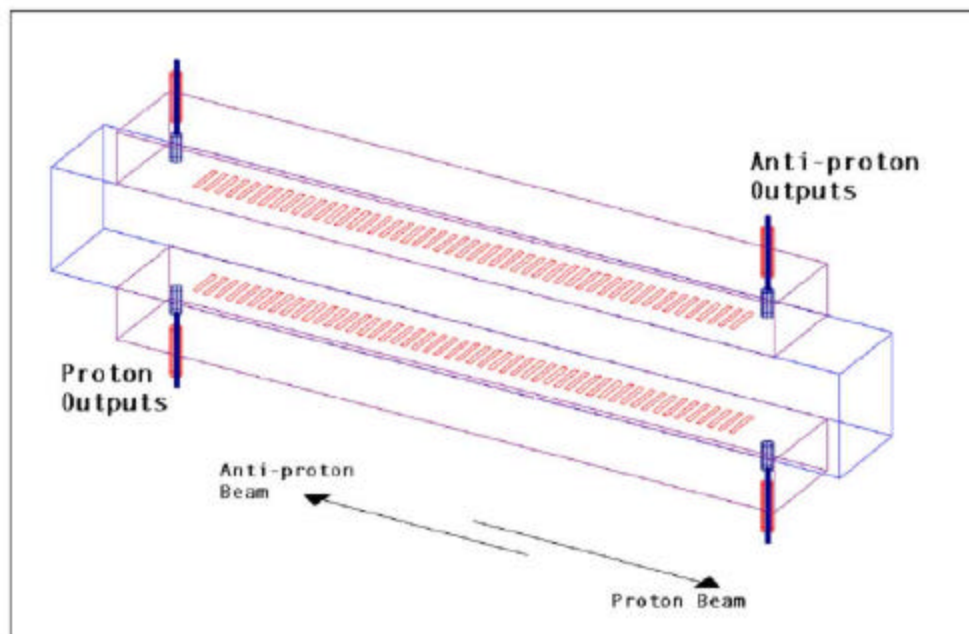




Pickup Design

- The pickup design was adapted from a stochastic cooling system operating in the 4-8 GHz band.
- The design uses a waveguide coupled to the beam chamber with an array of slots.

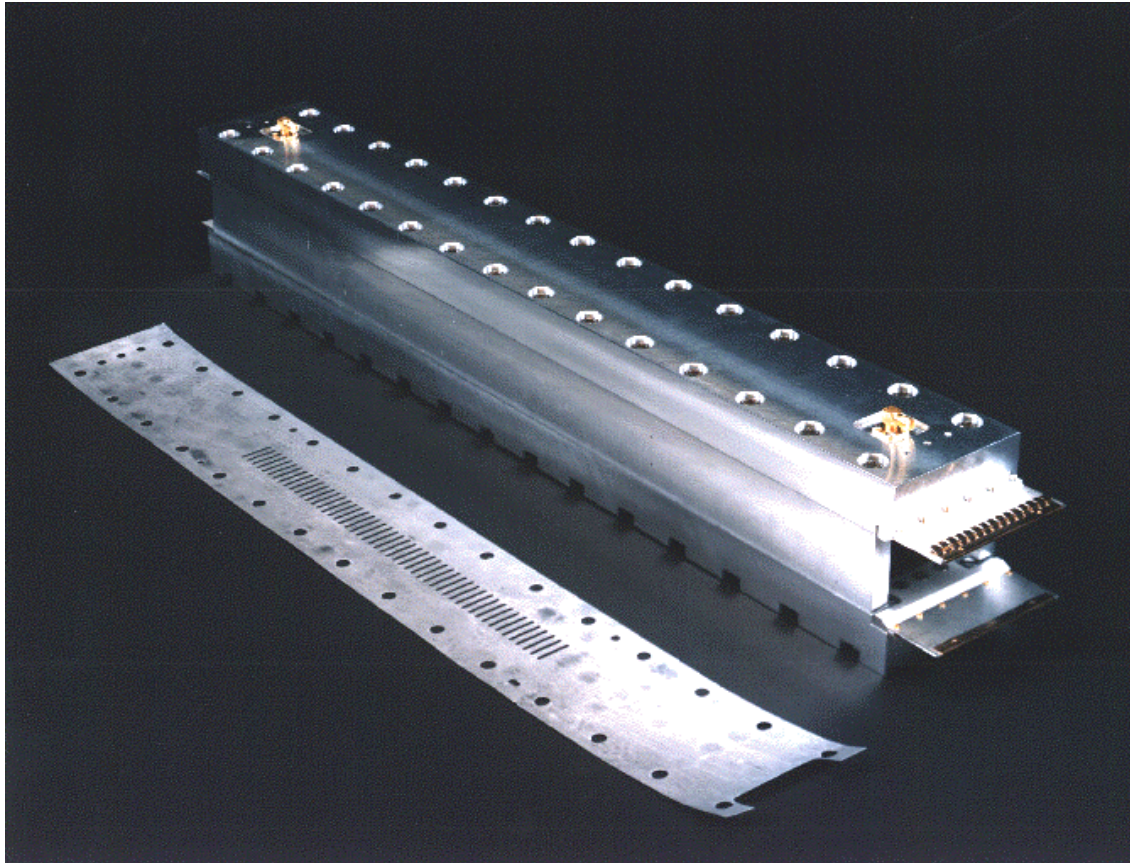
Slotted Waveguide Pickup



1.7 GHz 109 x 75 mm aperture

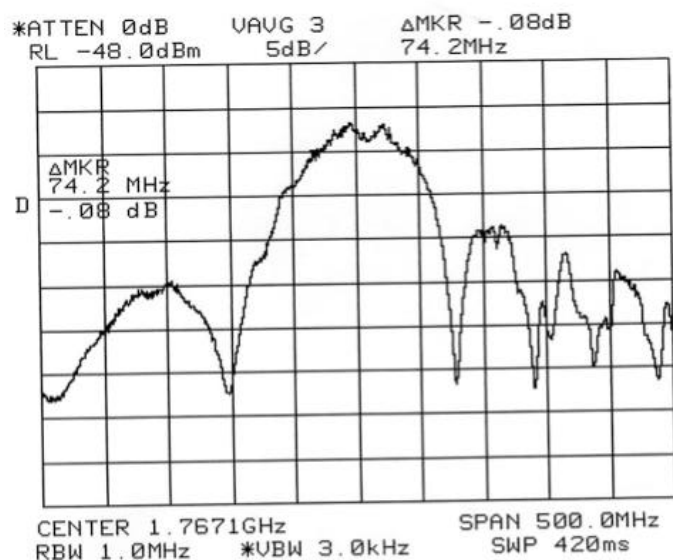
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Test Tank 6 GHz Array

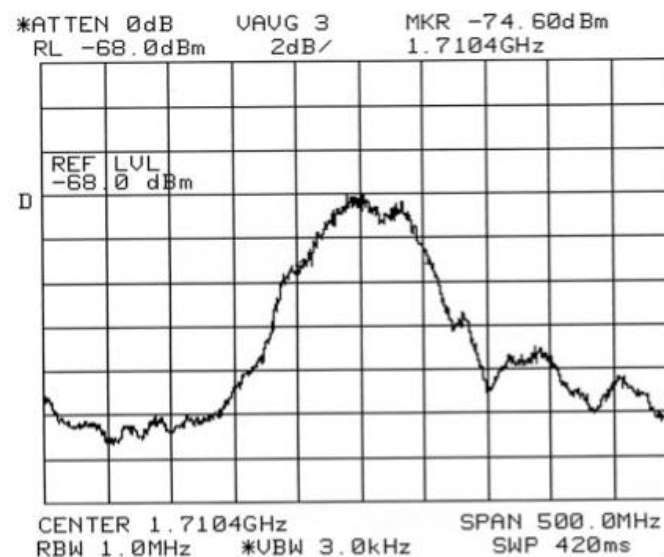


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Measured Pickup Sensitivity in Recycler



Sum Mode

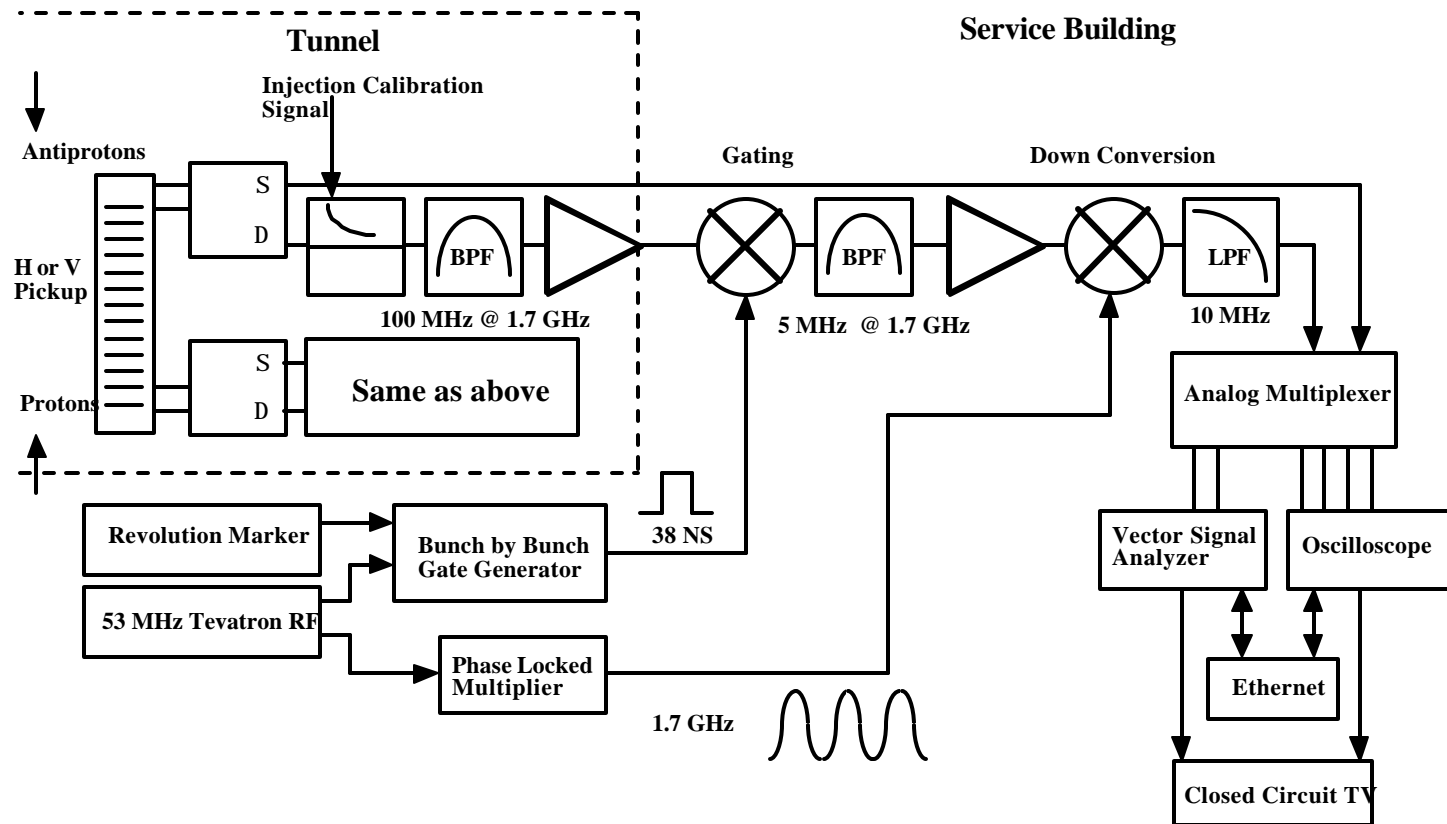


Difference Mode

Directivity Measured at 12-15 dB



Tevatron Schottky Signal Processing





Schottky Pickup for LHC

- A high-frequency, broadband Schottky pickup can be built for LHC with rather little R&D.
- Development of the Tevatron pickup as a diagnostic tool continues.